
Simple Harmonic Motion

An Educator's Reference Desk Lesson Plan

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Endorsed by: These lesson plans are the result of the work of the teachers who have attended the Columbia Education Center's Summer Workshop. CEC is a consortium of teacher from 14 western states dedicated to improving the quality of education in the rural, western, United States, and particularly the quality of math and science Education. CEC uses Big Sky Telegraph as the hub of their telecommunications network that allows the participating teachers to stay in contact with their trainers and peers that they have met at the Workshops.

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Grade Level(s): 4, 5, 6

Subject(s):

- Science/Physics

OVERVIEW: Simple harmonic motion (SHM) is a special type of regular oscillation. It is a common and familiar phenomenon and occurs whenever an object that is in equilibrium (under the action of forces) is disturbed slightly from its equilibrium position. There are many simple demonstrations of SHM that can be done as hands-on experiments that will show this phenomenon clearly.

PURPOSE: The purpose of this lesson is to help students understand the theory of simple harmonic motion (SHM) by performing hands-on, practical application experiments.

OBJECTIVES: Each student will demonstrate SHM by performing a series of demonstrations of regular oscillation and explaining the theory behind the experiment to a partner.

RESOURCES/MATERIALS: metronome, strings of various lengths, bobs of different weights, diving board, World Book Science Book, Physics Today p.54-55.

Terms:

kinetic energy

momentum

potential energy

harmonic

motion

oscillation

friction

acceleration

gravity force

ACTIVITIES AND PROCEDURES:

1. The pendulum -
Show the movement of a simple pendulum bob and explain SHM. When the bob is hanging downward it is in equilibrium position. When it is disturbed, it executes SHM. Gravity pulls it back to equilibrium position but momentum carries it past that position to another point. It relies on acceleration due to gravity to keep swinging. Try different lengths of string and different weights of bobs and see what happens. Which moves slower, a heavy bob or a light bob? What difference in acceleration is observed due to length of string? What else did you observe?
2. The metronome -
This inverted compound pendulum executes SHM when set into motion by a force. The period of swing can be altered by varying the position of the small weight on the arm of the metronome. How does the weight set near the top of the arm affect the swing of the arm, faster or slower? What happens when the weight is moved to the bottom of the arm? Is the swing equal on each side of the position of equilibrium?
3. A diving board -
This oscillates with SHM after the diver has started into his dive. Before this when the diver is bouncing to gain maximum height, the board undergoes forced oscillation. Observe a diver as he makes a dive, or set up a simulation of a dive in the classroom.

Can you think of any other practical applications of SHM?

TYING IT ALL TOGETHER:

Take a visit to Hansen Planetarium (Salt Lake City, Utah) or any other science museum that may have a swinging pendulum. Explain the movement of the pendulum in relation to the rotation of the earth. This is a fine example of SHM.

While there go to a star show!